U.S. DEPARTEMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE
WOOD-15 TECHNICAL NOTES SPOKANE, WASHINGTON
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WATER NEEDS OF WINDBREAKS FOR TRICKLE IRRIGATION SYSTEM DESIGN

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Establishment, survival and optimum growth of windbreaks is necessary to provide the planned level of protection for adjacent fields, farmsteads or feedlots. The majority of windbreaks in the state of Washington occur in a semi-arid to arid environment and water needs for temporary or permanent irrigation must be considered. The accompanying procedure aids in determining the degree of irrigation development needed, taking into consideration the climatic conditions, soil, and plant species.

The objective of the Natural Resources Conservation Service (formerly the Soil Conservation Service) is to insure optimum plant growth and deep root establishment for windbreaks as they develop. This is accomplished by providing adequate water during critical growth periods in a timely manner and with proper placement of lines and emitters to insure balanced root growth. The amount of water supplied depends on the specific species requirements, the annual moisture received and the capacity of the soil to retain sufficient moisture for the desired plant species response.

Species suited to various soils and their expected growth under irrigation are contained in Section II-N of the field office technical guide (Now in FOTG archives in all NRCS field offices). To achieve the expected growth indicated in Section II-N, four systems design levels must be considered for optimum and sustained plant growth and vigor. Based upon well drained, non-saline soils and species suitability, they are:

Level 1: Permanent full irrigation designed for peak use.

Level 2: Permanent irrigation to the fifth year of growth with capacity to supply supplemental water during drought years or above-average temperature growth season.

Level 3: Temporary irrigation installation to the third year of establishment (the system removed thereafter); however, it is recommended that the system be retained to maintain HIGH water use group species during drought years or above-average temperature growing season.

Level 4: No system is needed unless the landowner desires accelerated tree and shrub growth, or to insure survival of plants during drought years or above-average temperature growing seasons.

Table 1 and the potential plant rooting width from Table 2 by plant species, can be used to complete the attached Water Needs Worksheet. The results of the worksheet will establish the water need and system like requirement for the planned or existing windbreak being evaluated.

Table 1: Water Use Factor

Mean Annual Precip. Inches	AWC Total to 60 inches	Effective Moisture Subgroup	Design Level Needed	Use Factor* Plant Species Use Group (Table 2)		
				Low	Medium	High
<12	All	A, B	1	12	20	31
12-18	<7.5	C, D	1	10	17	27
	>7.5	C, D	2	6	11	17
18-35	<3.75	E, F	2	4	9	14
	3.75-7.5	E, F	3	3	5	7
	>7.5	E, F	4	0	0	0
>35	<3.75	N/A	3	2	4	6
	>3.75	N/A	4	0	0	0

* Use the next highest use factor and design level if drought conditions or above-average growing season temperatures are a concern.

Table 2: Windbreak Species Rooting Widths

Water Use Consumptive Groups:	Typical Between Tree Spacing		Typical Root Width at 20 yrs.
	Multiple Row (ft.)	Single Row (ft.)	(ft.)
HIGH USE GROUP:			
lombardy poplar	5	4	30
hybrid poplar	8	6	30
golden, black or weeping willow	12	8	30
MEDIUM USE GROUP:			
black locust, Siberian elm, green ash	12	8	30
Austrian pine, ponderosa pine	12	8	30
eastern redcedar	9	6	15
Scotch pine	12	8	20
blue spruce, Norway spruce, Douglas-fir	12	8	25
northern white-cedar	9	6	20
LOW USE GROUP:			
Siberian peashrub, common Lilac	3	2	10
Tatarian honeysuckle, common privet	3	2	8
Nanking cherry, Peking cotoneaster	3	2	4
Russian-olive	9	6	20
Rocky Mountain juniper	9	6	15

NOTES:

1. Match consumptive use and root zone width for a species not listed with one that is.

2. "Typical Between-Tree Spacings" for trees can aid in the early placement of emitters.

3. The "Typical Root Width: at 20 years is not to be used for actual row-to-row spacing (the width indicates a root density factor for irrigation computations only).

The design level will insure compliance with the purpose of farmstead and field windbreak standards: To protect the soil resources, control snow deposition, prevent wind damage, protect farmsteads, crops, livestock, orchards, and wildlife, or increase the natural beauty of the area.

The procedure followed by using the Water Needs Worksheet, Attachment 1, is intended for trickle irrigation supply systems. However, the determination of windbreak water needs is applicable to all forms of irrigation.

WINDBREAK DRIP IRRIGATION
WATER NEEDS WORKSHEET

Cooperator:_____ Plan/Com.:_____

Conservationist:_____ Date:_____

Step 1: Record the selected species (from F.O.T.G. Section II-N) and their water use factor from Table 1:

	Species	Use Factor		Species	Use Factor
Row 1	_____	_____	Row 4	_____	_____
Row 2	_____	_____	Row 5	_____	_____
Row 3	_____	_____	Row 6	_____	_____

Step 2: Record the species root width from Table 2, and the row length, to calculate the are to be wetted:

	Species Root Width (ft.)	Row Length (ft.)	Area (ft.)		Species Root Width (ft.)	Row Length (ft.)	Area (ft.)
Row 1	_____	_____	_____	Row 4	_____	_____	_____
Row 1	_____	_____	_____	Row 4	_____	_____	_____
Row 1	_____	_____	_____	Row 4	_____	_____	_____

Step 3: Determine the gallons per day needed per windbreak row. The basic equation is: [(Use Factor) x (Wetted Area)] / (Efficiency %) = gallons/day/row;
e.g. 31 x 15,000 / 90 = 5,167 gal./day/row

Row 1 (_____) x (_____) / (_____) = _____ gal./day/row
Row 2 (_____) x (_____) / (_____) = _____ gal./day/row
Row 3 (_____) x (_____) / (_____) = _____ gal./day/row
Row 4 (_____) x (_____) / (_____) = _____ gal./day/row
Row 5 (_____) x (_____) / (_____) = _____ gal./day/row
Row 6 (_____) x (_____) / (_____) = _____ gal./day/row

Efficiencies: Point Source on Ground = 90% Spray Emitter = 80%
Point Source Suspended = 80% Bubbler = 85%

Step 4: The system will be (check one): Permanent _____ Temporary _____

Step 5: The system will need to be designed and balanced to provide the necessary amounts of water above by a person with appropriate engineering authority or by a certified irrigation dealer. Provisions for water management, lines, emitters, etc. for the early years of the windbreak must be part of the design and water management scheme.